UNIVERSITI TEKNOLOGI MARA

SYNTHESIS OF 1,4,7,10-TETRAAZACYCLODODECANE (CYCLEN) COMPOUND FOR MOLECULAR STUDY PURPOSES.

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ABSTRACT

The main objective of this study is to synthesize a macrocyclic compound, 1,4,7,10-tetra-azacyclododecane (cyclen). There are several techniques involved in order to synthesize this compound. Although in this experiment, only one method was choosen from several methods that are able to synthesize this compound. This experiment used Diethylenetriamine (DT) and Diethanolamine (DE) as starting material. The Diethylenetriamine and Diethanolamine are tosylated first by using para-toluene benzyl chloride or called Tosyl chloride (TsCl) with addition of triethylamine as a base and dichloromethane as a solvent. Diethylenetriamine preparation will yield N-Tosyl as a product and Diethanolamine will yield O-Tosyl as a product. Both of these products then coupled to yield the compound called cyclen that are very useful for the molecular study purposes. The already-made cyclen product from the factory made or commercially is available, but it is quite expensive, so that this experiment done to produce cyclen by ownself for the further purposes. Thin Layer Chromatography (TLC) is used for all of the chemical analysis and identification.

CHAPTER 1

INTRODUCTION

1.1 Introduction of cyclen

1,4,7,10-tetra-azacyclododecane or cyclen is a macrocycle and the aza analogue of crown ethers. Derivatives of cyclen are larger cyclic polyamines but the repeating unit (ethyleneimine) is always the same. Like crown ethers, cyclen compounds are capable of selectively binding cations (Wikipedia, 2006).

Cyclen is an important macrocyclic tetraamine that has been used extensively in metal complexation (Bianchi, A. *et al.*, 1991) and as a synthetic precursor to related pendant-armed (Bernhardt, P. V. *et al.*, 1990) and bridged polydentate ligands (Micheloni, M. J. *et al.*, 1988), some of which have biomedical applications. The 12-membered cyclic tetramine cyclen (1,4,7,10-tetraazacyclododecane) **1** is a tetraaza macrocycle which is have a great practical importance.

1.2 The uses of 1,4,7,10-tetraazacyclododecane 1

Complexes of some of cyclen based ligands have found applications as Magnetic Resonance Imaging (MRI) contrast agents, radiopharmaceuticals, luminescent probes, *in vivo* temperature probes, and *in vivo* Nuclear Magnetic Resonance (NMR) shift reagents. The analysis of single nucleotide polymorphisms (SNPs) is increasingly utilized in the